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Green *Jatropha* Motor Oil (G-Jamo) Synthesis using Treated Cockel Shell Waste (TCSW) Catalyst

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EXTENDED ABSTRACT

Non-victual oil as inexhaustible reserves has risen an enthusiastic task for motor oil synthesis. Green synthesis of motor oil was run in a bath stirrer flask via two-stages catalytic transesterification. Reactions transesterification of trimethylolpropane (TMP) and *Jatropha* oil methyl ester (JOME) were carried out under treated cockle shell waste (TCSW) catalysts. Reaction time, catalyst loading, JOME and TMP ratio and temperature influence on G-JAMO (TMP-ester) were also investigated. The favourable triester composition (73.03%) and G-JAMO (TMP-ester) conversion (96.95%) were obtained by the JOME and TMP ratio of 1:4, time of 3 h, temperature of 110°C and catalyst loading of 3 wt/wt%. Synthesized lubricant oil performance gave viscosity index of 83, flash point of 215°C, density of 832 kg/m³, pour point of -6°C and kinematic viscosity at 40°C of 34.32 mm²/s. The physical chemical properties of *Jatropha* motor oil are appropriate with another plant oil feedstocks, used catalysts and justified standards. Utilization of non-edible and renewable corps, like *Jatropha* is expected to minimize issues of food supply chain. In addition, increased environmental awareness and diminishing petroleum resources that leads to search for an alternative non-edible crops for bioenergy production. Oil from *Jatropha* is a valuable product with feature that have low acidity, high oxidative stability and good lubricity [1]-[3]. Synthesis of motor oil from *Jatropha* as an alternative sources and trimethylol propane (TMP) could be applied. TMP is a type of polyol which is cheaper and react at lower temperature as compared to other polyol such as neopentylglycol (NPG) and pentaerythritol and able to react at lower temperature. Therefore, to overcome the limitations of TMP-ester or biolubricant synthesis from plant oils, it was discovered by replacing the presence of the glycerol with another polyhydric alcohol such as TMP and NPG [4]. A number of reports and reviews have been being done for motor oil synthesis from non-renewable resources, like karanja oil by peroxyformic acid, waste cooking oil via hydrogen peroxide, castor oil under sodium hydroxide, vegetable oil in water-based mud, canola oil and biodiesel via epoxidation [5]-[10]. Then, a substantial obstacle to find heterogeneous base catalyst for transesterification process under mild reaction conditions in shorter reaction time. Alkaline earth metal oxides from shells with high basicity especially calcium oxide is one of the most promising heterogeneous base catalysts for methyl ester production. Commonly, most of the shell wastes end in the landfill without any pre-treatment because it was traditionally useless. The use of shells waste as an alternative raw material for catalyst production can raise its economic value and solution for the waste problems. Cockle shell containing CaCO₃ can be converted into CaO via calcination process, it can be widely used in daily practices and industries such as in wastewater and sewage treatment, agricultural, glass production and more. Next, advantageous of calcium oxide derived from shell waste are reusable catalyst post processed, high activity and low cost [11]. Furthermore, a lot of motor oil synthesis have been being conducted, but fewer reports about the *Jatropha* oil conversion to TMP-ester using altered solid catalysts. Thus, this work intention is to employ the calcined cockell shell for conversion of treated *Jatropha* oil to trimethylpropane (TMP)-ester. The *Jatropha* oil as non-edible vegetable feedstock has high lucidity, which is found and distributed widely around the earth, has been becoming interesting issues for its conversion to green *Jatropha* motor oil (G-JAMO). Vicious circle of *Jatropha* oil methyl ester (JOME) and trimethylolpropane (TMP) were tested under treated cockel shell waste (TCSW) catalysts. Influences of catalyst loading, ratio of JOME and TMP, reaction time and temperature were also examined. The non-and

calcined catalyst morphology, parameters process impacts and scheme of *Jatropha* oil conversion to TMP-ester can be exhibited in the Fig. 1, 2, 3 and 4.

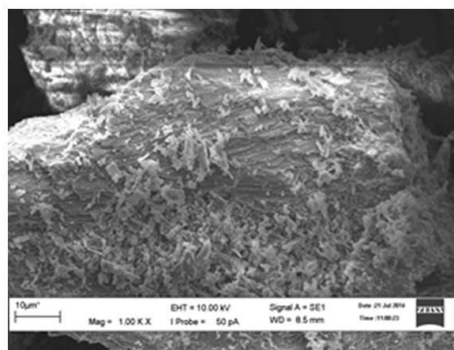


Fig. 1: SEM image of non-treated cockle shell waste (N-TCSW).

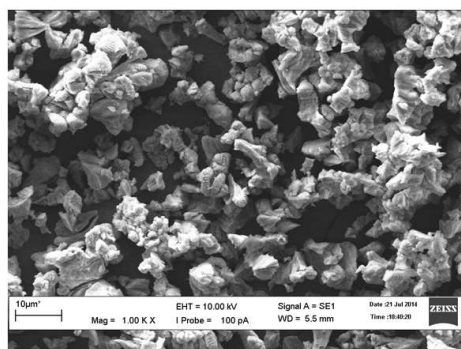


Fig. 2: SEM image of treated cockle shell waste (TCSW).

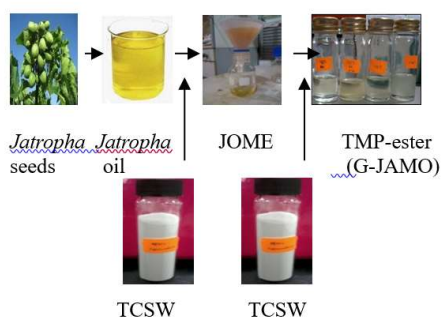


Fig. 3: Scheme of G-JAMO (TMP-ester) synthesis using TCSW.

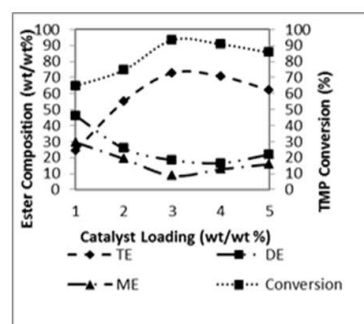


Fig. 4: COME and TMP ratio vs G-JAMO. (TMP-ester)

Keywords: Non-victual oil; Catalytic transesterification; Ester; TCSW; Lubricant oil.

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